

1           1.    A dual-mode transceiver of the indoor and outdoor  
2                UWB communication comprising:  
3                a digital enlarged band lowpass-shaping  
4 transmitter FIR filters for the indoor UWB operation;  
5                a digital enlarged band lowpass-shaping  
6 transmitter FIR filter for the outdoor UWB operation; and  
7                a common digital rejected image spectrum  
8 transmitter FIR filter.

9  
10           2.   The dual-mode transceiver of claim 1 wherein the  
11 cascaded two digital filters of said indoor digital  
12 enlarged band lowpass-shaping transmitter FIR filter and  
13 said common digital rejected image spectrum transmitter FIR  
14 filter are used for implementing an indoor UWB transceiver  
15 mode.

16  
17           3.   The dual-mode transceiver of claim 1 wherein the  
18 cascaded two digital filters of said outdoor digital  
19 enlarged band lowpass-shaping transmitter FIR filter and  
20 said common digital rejected image spectrum transmitter FIR  
21 filter are used for implementing a outdoor UWB transceiver.

22  
23           4.   The dual-mode transceiver of claim 1 wherein said  
24 common digital rejected image spectrum transmitters FIR  
25 filter comprising two filter structures is only one filter

26 that can be used for both of the indoor and outdoor UWB  
27 operation mode.

28

29 5. The dual-mode UWB transceiver of claim 4 wherein  
30 said common digital rejected image spectrum transmitter FIR  
31 filter contains two sub-filters, one sub-filter with even  
32 filter taps and other sub-filter with odd filter taps.

33

34 6. The dual-mode transceiver of claim 5 wherein said  
35 even tap sub-filter and said odd tap sub-filter stored in  
36 memory banks are implemented with polyphase structure by  
37 controlling a switch.

38

39 7. The dual-mode UWB transceiver of claim 1 wherein  
40 said indoor digital enlarged band lowpass-shaping  
41 transmitter FIR filter coupled to said common digital  
42 rejected image spectrum transmitter FIR filter is a  
43 combination interpolation lowpass-shaping transmitter FIR  
44 filter with upsampling of 2 for implementing an indoor UWB  
45 transceiver.

46

47 8. The dual-mode transceiver of claim 1 wherein said  
48 outdoor digital enlarged band lowpass-shaping transmitter  
49 FIR filter coupled to said common digital rejected image  
50 spectrum transmitter FIR filter is a combination  
51 interpolation lowpass-shaping transmitter FIR filter with

52   upsampling of 2 for implementing an outdoor UWB  
53   transceiver.  
54

55         9.   The dual-mode transceiver of claim 1 wherein said  
56   indoor digital enlarged band lowpass-shaping transmitter  
57   FIR filter and said outdoor digital enlarged band lowpass-  
58   shaping transmitter FIR filter and said common digital  
59   rejected image spectrum transmitter FIR filter stored in  
60   memory banks are programmable filter taps.  
61

62         10.   The dual-mode transceiver of claim 9 wherein said  
63   indoor and outdoor digital enlarged band lowpass-shaping  
64   transmitter FIR filters are programmable to have 51 odd  
65   symmetric filter taps, and said common digital rejected  
66   image spectrum FIR filter is programmable to have 6 even  
67   symmetric filter taps.  
68

69         11.   A dual-mode implementation system of digital  
70         lowpass-shaping transmission FIR filter  
71         comprising:  
72         a set of memory banks;  
73         a set of counter units;  
74         a set of MAC units;  
75         a pre-addition unit;  
76         a MUX unit; and  
77         a selectable unit.

78           12. The dual-mode implementation system of digital  
79 lowpass-shaping transmission FIR filter of claim 11 wherein  
80 the input samples are added together with symmetric using  
81 said pre-addition unit.

82

83           13. The dual-mode implementation system of digital  
84 lowpass-shaping transmission FIR filter of claim 11 wherein  
85 said MUX unit with said selectable unit is used to select  
86 either said memory bank of the indoor digital enlarged band  
87 transmitter FIR filter coefficients or the memory bank of  
88 the outdoor digital enlarged band transmitter FIR filter  
89 coefficients.

90

91           14. The dual-mode implementation system of digital  
92 lowpass-shaping transmission FIR filter of claim 11 wherein  
93 the first stage outputs in the data memory bank may be  
94 multiplied with the common digital FIR filter taps of the  
95 polyphase memory banks to produce the output for a digital-  
96 to-analog converter.

97

98           15. The dual-mode implementation system of digital  
99 lowpass-shaping transmission FIR filter of claim 14 wherein  
100 the same reconstruction analog filter and said digital-to-  
101 analog converter for both indoor and outdoor UWB  
102 transceiver modes.

103

104           16. A dual-mode indoor and outdoor UWB receiver FIR  
105 filter comprising:

106                 an indoor digital lowpass receiver FIR filter;  
107                 and an outdoor digital lowpass receiver FIR  
108 filter.  
109

110           17. The dual-mode indoor and outdoor UWB receiver FIR  
111 filter of claim 16 wherein said indoor digital receiver FIR  
112 filter and said outdoor digital receiver FIR filter are  
113 programmable to have 39 filter taps with odd symmetric.  
114

115           18. An article comprising a medium for storing  
116 instructions that cause a digital signal processor-based  
117 dual-mode indoor and outdoor UWB transceiver to:

118                 Selectively set the memory bank of transmitter  
119 filter in the first filtering stage depending on whether an  
120 indoor or outdoor UWB transmission signal has been  
121 detected; and resulting output of the first filtering stage  
122 as the input samples are filtered by the common digital  
123 rejected transmitter filter;

124                 Selectively set the memory bank of receiver  
125 filter depending on whether an indoor or outdoor UWB  
126 receiver signal has been received.  
127

128           19. The article of claim 18 further storing  
129 instructions that cause a digital signal processor-based

130 dual-mode indoor and outdoor UWB transmitter to control the  
131 MUX unit to select either the memory bank of said indoor  
132 digital enlarged band lowpass-shaping transmitter FIR  
133 filter taps or the memory bank of said outdoor digital  
134 enlarged band lowpass-shaping transmitter FIR filter taps  
135 multiplied with the input samples as the outputs coupled to  
136 the polyphase-based digital rejected FIR filter.

137

138         20. The article of claim 18 further storing  
139 instructions that cause digital signal processor-based  
140 dual-mode indoor and outdoor UWB receiver to control said  
141 MUX unit to select either the memory bank of said indoor  
142 digital receiver FIR filter taps or the memory bank of said  
143 outdoor digital receiver FIR filter taps multiplied with  
144 the input samples.